BIOLOGY AND MANAGEMENT OF THE DEMERSAL SHELF ROCKFISH RESOURCE IN SOUTHEAST ALASKA

By

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INTRODUCTION

Demersal shelf rockfish have been landed incidental to commercial fisheries for halibut, sablefish, and salmon since the early 1900's. In 1979 a small shore-based fishery directed at rockfish began in the Sitka area of Southeast Alaska. Since that time rockfish landings have increased dramatically throughout the region. The directed harvest increased from approximately 350,000 pounds (160 mt) of all rockfish in 1982 to a peak of nearly 2.7 million pounds (1,225 mt) of demersal shelf rockfish, alone, during the 1986-87 season. There is strong evidence that the current high levels of harvest cannot be sustained.

Other commercial longline fisheries in the area, such as the halibut and sablefish fisheries, have become progressively shorter as more participants entered the fisheries, the individual fishermen have become more effective, or it has become necessary to limit the amount of fish harvested. The current market for demersal shelf rockfish requires that fish be delivered fresh over much of the year. Therefore, to reduce the risk of losing those markets, the fishery must be managed in such a way that it is not compressed into very short open periods. This presents a management challenge because utilizing only conventional management tools such as time and area closures or harvest limits has resulted in progressively shorter seasons in other fisheries.

By 1987 evidence of declining stocks was observed in several areas and it became obvious that some regulation of this fishery was needed to assure conservation of the rockfish resource. In April, 1988 the Alaska Department of Fish and Game requested and received funding from the Federal Interjurisdictional Fisheries Fund to develop a demersal shelf rockfish management plan for Southeast Alaska. The funding was administered through the Pacific States Marine Fisheries Commission (PSMFC).

A large portion of the first-year funding was used to formulate an industry Rockfish Work Group and to underwrite the cost of conducting two workshops with that group. The purpose of the Work Group was to bring active members of the harvesting and processing sectors of the industry together to consider management options for this fishery, to establish management goals and objectives, and to recommend preferred regulatory changes to meet those objectives. The Work Group was comprised of processors and fishermen from each of the region's primary rockfish ports. The local Fish and Game Advisory Committees assisted with the selection of the participants from each community. Staff support was provided by the Alaska Department of Fish and Game (ADF&G) and the Commercial Fisheries Entry Commission (CFEC).

The first workshop was held on June 1, 1988 and the second workshop was held September 22, 1988. As a result of these meetings, the Work Group submitted three recommendations for consideration by the Alaska Board of Fisheries (Board) during it's 1989 winter meeting in Petersburg. Work Group proposals included a split season, a weekly trip limit, and mandatory use of logbooks by all participants in the directed rockfish fishery. The Work Group proposals and the rational behind them were presented to the Board by a member of the Work Group in early February, 1989.

ADF&G staff also submitted several proposals for changes in rockfish regulations to the Board. These included creation of defined management areas, establishment of directed fishery harvest ranges for each area, a regulation to liberalize the allowance for retention of incidental rockfish in the halibut fishery and a proposal to set aside areas of Southeast Alaska for reproductive reserves and control study areas.

This report presents a brief overview of rockfish biology, a history of the fishery, it lists the goals and objectives for rockfish management which were developed by the Work Group, it describes the regulations which were adopted by the Board, and it outlines ADF&G's approach to commercial rockfish management that will be in effect during the 1989-90 and 1990-91 fishing seasons.

BIOLOGY OF DEMERSAL SHELF ROCKFISH

The demersal shelf rockfish fishery in Southeast Alaska has developed so rapidly that no extensive time series of biological or fisheries performance data exists for the species included in this management category. The limited information that is available for these species is from ADF&G port sampling, fisheries monitoring, and other research programs since 1981. A summary of the available data is contained in this section.

Species Included

Ten species of *Sebastes* rockfishes are included in the demersal shelf rockfish management category. They represent the rockfish species which are most commonly taken by set line gear on the continental shelf in the Eastern Gulf of Alaska. The name "demersal shelf" refers to the fact that they are primarily bottom-dwelling species of the continental shelf. The species included are, in alphabetical order by common name:

Bocaccio (*Sebastes paucispinis*),
Canary rockfish (*S. pinniger*),
China rockfish (*S. nebulosus*),
Copper rockfish (*S. caurinus*),
Quillback rockfish (*S. maliger*),
Redstripe rockfish (*S. proriger*),
Rosethorn rockfish (*S. helvomaculatus*),
Silvergray rockfish (*S. brevispinis*),
Tiger rockfish (*S. nigrocinctus*),
Yelloweye rockfish (*S. ruberrimus*).

Age Distribution and Natural Mortality Rates

While aging of nearshore rockfish from Alaska has not yet been validated, commonly accepted methods for rockfish aging are used. Methods used for aging similar species indicate extreme ages for some Southeast Alaska rockfishes such as yelloweye and quillback. Individual yelloweye rockfish have been aged in excess of 100 years and samples from commercial landings in some Southeast Alaska fisheries indicate an average age of over 50 years for that species (O'Connell and Funk 1987). Preliminary aging data suggests that the two primary species represented in the catch, yelloweye rockfish and quillback rockfish, do not attain sexual maturity until they are 12 to 15 years of age or older and may not recruit fully to the fishery until even older.

Available data indicates that the instantaneous rate of natural mortality is less than 0.04 for yelloweye rockfish (O'Connell and Bracken 1988). For long-lived species such as rockfish, managers normally set the harvest level at an amount which does not greatly exceed the natural mortality rate to minimize the risk of significant population declines. The rate at which the population declines depends to a large extent on the level of additional mortality induced by fishing.

In order to manage a resource using the estimated annual yield, an estimate of the available biomass is required. Unfortunately, no such estimate is currently available for demersal shelf rockfish in Southeast Alaska. However, with these low natural mortality and production characteristics, sustainable annual yield levels are assumed to be extremely low.

Reproduction

All rockfish in the genus Sebastes are ovoviviparous, extruding live larva after a reproductive cycle which begins with internal fertilization and extends over several months. Not all species have concurrent cycles, hence some portion of the reproductive cycle, either copulation, fertilization, maturation, or parturition, occurs for some rockfish species over much of the year (O'Connell 1987). For these reasons closures to protect spawning stocks are not considered to be an effective management tool.

Habitat

Rockfishes inhabit depths from 5 to over 100 fathoms (11 to 217 meters) with the greatest abundance between 20 and 80 fathoms (43 to 173 meters). Demersal shelf species live on the bottom most of their lives. They are generally found associated with rocky substrate, normally with high bottom relief such as pinnacles and reefs, and all species are very habitat specific. ADF&G surveys and fishermen's logbook data have shown that a longline set only a few meters from the desired location will often result in a substantial change in number of fish caught and in species composition of the catch. The high

degree of habitat specificity and lack of movement found for these species renders them particularly vulnerable to overexploitation. This characteristic also increases the time needed to repopulate an area once the stock is reduced.

Physiology

All *Sebastes* rockfishes have a physoclistic (closed) gasbladder. Because of this, all *Sebastes* rockfish, particularly the bottom-dwelling demersal shelf rockfish, are susceptible to extensive soft tissue damage or death from decompression when they are brought to the surface. This decompression damage results in the "bug eyed' appearance and the everted stomachs often observed when these fishes are caught. Because the mortality associated with harvest is so high, size limits or individual species quotas are not considered to be viable management options.

HISTORY OF THE FISHERY

The directed near shore rockfish fishery began in 1979 in the Sitka area as a small fresh fish business. Automatic jigging machines were utilized and most of the fish landed were of species not included in the demersal shelf rockfish assemblage. By 1982 rockfish fishing effort had increased considerably and set line gear had largely replaced jigging machines as the principal gear type. With the change of gear the catch composition changed from primarily pelagic (off bottom) shelf species to primarily demersal shelf species.

By 1986 the fishery was well established throughout Southeast Alaska and total rockfish production during that year increased to over 2 million pounds (907 mt). By that time there were indications that the resource was being rapidly depleted in some areas. The fishery continued to expand and peaked during the 1986-87 season with landings of nearly 2.7 million pounds (1,225 mt) of demersal shelf rockfish reported.

The catch dropped significantly during the 1987-88 season to approximately 1.8 million pounds (815 mt). Much of this reduction in harvest can be attributed to implementation of preliminary harvest limits and the resulting season closures. In some areas of Southeast Alaska, however, the harvest limits were not fully achieved apparently because of reduced effort and lower catch rates.

Description of the Area

Southeast Alaska has been divided by ADF&G into five areas for commercial groundfish catch monitoring and rockfish management (Figure 1). The areas include two internal water areas, the Northern Southeast Inside (NSEI) area and the Southern Southeast Inside (SSEI) area. Each of these areas represents approximately one half of the internal waters of Southeast Alaska. Three offshore management areas were also established, the Southern (SSEO), Central (CSEO), and Northern (NSEO) Southeast Outside management areas. The CSEO area includes all waters along the outer coast between 56° and 57°30' N latitude and west of 137° W longitude. The 56° N latitude line is the northern boundary of the SSEO area and 57°30' N latitude is the southern boundary of the NSEO area. The NSEO area extends west from that line to 137° W longitude. The SSEO area extends southward from 56° to the southern boundary of the U. S. Exclusive Economic Zone (EEZ) off Dixon Entrance.

These management areas represent the general geographic separation of the fleets from the various communities where rockfish are landed. The two internal areas are entirely within State territorial waters, while the three outside areas contain both State waters and waters of the Federal EEZ.

Distribution of the Commercial Harvest

Through 1985 well over 50% of the total Southeast Alaska commercial rockfish landings were reported from the Central Southeast Outside (CSEO) management area with Sitka as the primary port of landing. By 1986, however, landings from the CSEO area dropped to 37% of the Southeast Alaska total. In 1986 the Southern Southeast Inside (SSEI) was the lead producer of rockfish in the region with over 41% of the total Southeast Alaska rockfish harvest.

Not only did the percentage of the total Southeast Alaska rockfish harvest taken in the CSEO area decline between 1984 and 1986, the actual harvest from that area decreased as well. The CSEO area peaked at 1,146,200 pounds (521 mt) in 1984 and declined to 767,800 pounds (349 mt) in 1986, a decline of 33%. This is considered notable in view of the fact that over that same time period there were no management restrictions on the fishery, rockfish markets remained strong throughout the region, and the total regional harvest increased dramatically.

During the period between 1984 and 1986 Sitka fishermen moved progressively further from their home port to maintain productive fishing. Through 1984 over 75% of all CSEO area rockfish landings were reported from grounds within 20 miles (32 km) of Sitka. By 1986, however, less than 45% of the fish landed from the CSEO area were from grounds within 20 miles (32 km) of Sitka and the majority of the landings were from grounds 20 to 80 miles (32 to 130 km) or more from port.

A similar shift of effort outward from grounds near Ketchikan to other portions of the SSEI area was also noted between 1985 and 1987. The amount of the total SSEI area landings harvested within a 20 mile (32 km) radius of Ketchikan decreased by 40% during that time period.

While the harvest in the CSEO area declined after 1984, the total Southeast Alaska harvest continued to increase in other portions of the region. By 1986 much of the effort had shifted into the SSEI management area with Ketchikan replacing Sitka as the major port of landing. During the 1986-87 season the fishery expanded further into the Southern Southeast Outside (SSEO) area. The 1986-87 season harvest was fairly evenly divided between the three primary fishing areas with 30% from the SSEI area, and 29% from the SSEO area, while only 27% of the harvest was reported from the CSEO management area. The remaining two management areas, the Northern Southeast Inside (NSEI) and Northern Southeast Outside (NSEO) areas have relatively limited rockfish resources and accounted for the remaining 14% of the regional landings.

The effort shifts both away from the primary port of landing within a geographical area and into new geographical areas, are considered noteworthy. As the fisheries move further away from an original port of landing, the ratio of travel time to fishing time and the cost of fuel are increased substantially. New markets and/or transportation links must be established each time the fishery transfers into a new area. Therefore, the shifts to new fishing grounds are considered to be strong evidence that the productivity on the fishing grounds near the original ports of landing had declined to the point that continued fishing in those areas was no longer profitable for many fishermen.

Harvest Rates

Statistically significant declines in catch-per-unit-of-effort (CPUE) were noted in both the SSEI and CSEO management areas between 1984 and 1986. Preliminary data indicates that CPUE continued to decline through 1987 in both management areas. Estimates are not yet available for 1988 and 1989. The CPUE values are estimates of pounds of marketable rockfish fish landed per hook as determined from logbook and skipper interview programs.

While CPUE has declined, it should be noted that this statistic may substantially underestimate the actual decrease in stock abundance of habitat specific species such as rockfish (Bracken and O'Connell, 1986). This is because the dynamic nature of the fishery, including changes in gear technology and markets, gained proficiency of skippers over time, and the high mobility of the fleets to new fishing grounds tend to keep catch rates high even as stocks are declining.

Fleet Composition

Over 99% of the 1987 and the 1988 demersal shelf rockfish harvest was landed on longline gear. Catch reports indicated that of 465 longline vessels reporting landings of rockfish in 1987 and 417 in 1988. However, the number of fishermen who make multiple landings or rely upon rockfish fishing for a major portion of their fishing income is a small percentage of the total number of participants in this fishery. Regardless, the large number of participants and relatively small guideline harvest ranges make compression of the season a serious management concern.

Discard in Other Commercial Fisheries

Rockfish are also landed in fisheries for other species. This incidental harvest has been occurring since the commercial fisheries first started in Southeast Alaska nearly 100 years ago. The amount of the total incidental rockfish catch which is marketed depends to a large extent upon the demand for rockfish at the time and the intensity of the target fisheries for other species.

Much of the incidental harvest is unavoidable and the vast majority of the discarded fish do not survive when brought to the surface. Therefore, this source of mortality must be taken into account when rockfish regulations are established. Methods to minimize unwanted rockfish catch and to encourage the full utilization of all harvested rockfish should be considered.

PREVIOUS MANAGEMENT

Currently developing groundfish fisheries are not regulated until enough data has been accumulated to justify management action. The result of this practice is that fisheries are often left unregulated at the onset and, as in the case with Southeast Alaska rockfish fisheries, by the time adequate information to justify management action is obtained, the fishery is fully developed and signs of stock depletion are evident.

In 1984 regulations were implemented which established the CSEO area as a rockfish management area and a harvest limit of 600 ton was set for that area. The limit was intended to place a cap on the harvest from that area at the projected 1984 level. In reality, the 600 ton limit was never reached and the harvest declined dramatically through the 1985-86 season (see distribution of harvest above). An October 1 season opening date and a restriction limiting rockfish harvest to hook and line gear only in State waters were also established in 1984 at the industry's request.

By early 1987 significant CPUE declines and other indicators observed in the SSEI and CSEO management areas made it clear that rockfish stocks were declining in those areas. Because of concern for conservation of the resource, ADF&G placed a high priority on establishing a preliminary rockfish management strategy. An interim management plan was completed and temporary regulations were established for the 1986-87 season.

ADF&G managed the demersal shelf rockfish fishery in both State and Federal waters during the 1986-87 and 1987-88 seasons based on the preliminary management plan. The plan established the five Southeast Alaska groundfish management areas and implemented preliminary rockfish harvest limits for each area. Those actions were taken to protect the stock from further overexploitation until permanent regulations could be developed by the Board of Fisheries.

In addition to the provisions outlined in the preliminary management plan, an emergency regulation was adopted in 1987 which allowed for a bycatch of up to 10% of demersal shelf rockfish, by weight, in fisheries for other species after the directed rockfish fisheries were closed. That provision was initiated to minimize the waste of rockfish in fisheries for other species. Later in 1987, after a series of public meetings, an emergency order was issued closing a portion of Sitka Sound to directed fishing for demersal shelf rockfish indefinitely.

Regulatory Authority

The demersal shelf rockfish fishery in Southeast Alaska is unique in that it is the only Alaskan groundfish fishery over which the State has limited regulatory authority in both State waters and the adjacent Federal Exclusive Economic Zone (EEZ). Authority over the rockfish fisheries in Federal waters is in accordance with a provision in the Gulf of Alaska Groundfish Fisheries Management Plan promulgated by the North Pacific Fisheries Management Council. The State's management authority in Federal waters is limited, however, since it only applies to State licensed or registered vessels. The provision also requires that State regulations must be at least as restrictive as, and may not conflict with, the Federal regulations. Therefore, the State cannot initiate management action which is inconsistent with established Federal regulations for this fishery.

In practice, the independent regulatory authority of ADF&G in Federal waters is limited to setting harvest levels and implementing time and/or area closures based upon biological information. Any in-season management action must be justified as necessary to conserve the resource.

Management decisions which allocate between users, such as setting seasons for non-biological reasons, gear restrictions, weekly fishing periods, trip limits, etc., must be approved by the Alaska Board of Fisheries and must be consistent with existing Federal regulations.

MANAGEMENT GOALS AND OBJECTIVES

Management goals and objectives were established for the Southeast Alaska demersal shelf rockfish fishery by the Rockfish Work Group, in consultation with ADF&G staff, during its 1988 meetings. A primary management goal and the accompanying objectives provided the basis for the rockfish regulatory proposals which were presented by the Work Group to the Board of Fisheries for consideration.

Principal Management Goal

The Southeast Alaska demersal shelf rockfish fishery is managed to provide positive economic and other benefits to the region while supporting a sustainable annual harvest of this resource. The benefits include, but are not limited to, profits to the fishing industry, benefits to consumers, income, employment, and recreational, personal, and subsistence uses.

Management Objectives

1. Establish annual harvest guidelines within known biological constraints for the demersal shelf rockfish fishery by management area for Southeast Alaska.

2. Manage the fisheries to minimize waste by encouraging the use of appropriate gear, setting the seasons to minimize the capture of unwanted rockfish, and set retention allowances which will minimize discard of unwanted rockfish which are harvested in all fisheries.

3. Develop methods to regulate the fishery to assure a continuous supply of high quality rockfish to the consumers throughout most of the year.

4. Maintain an economically viable fishery for the individuals involved.

REGULATIONS

This section includes a summary of the new rockfish regulations which were adopted by the Board of Fisheries at its meetings in February 1989. It also outlines the rockfish regulations which were previously adopted and are still in effect. For complete and specific regulatory language or a more detailed explanation of how they will be implemented review the Commercial Groundfish Fishing Regulations or contact any ADF&G Southeast Alaska management area office.

1. The five management areas which were established for rockfish and other groundfish management (Figure 1) were adopted based upon staff recommendations and will be used to describe the areas for future management action. These areas are described in more detail in the section entitled "description of the area" earlier in this report. These are the same management areas which have been used by the staff in Emergency Order openings and closures of rockfish and other groundfish fisheries the past two seasons.

2. Guideline harvest ranges for the directed rockfish fishery were also adopted. The ranges were recommended by ADF&G staff and endorsed by the Work Group. The approved ranges are approximately 50% to 67% of the preliminary limits used during the 1986-87 and 1987-88 seasons. The harvest ranges and current annual harvest objectives for each area are listed in Table 1. The annual harvest objective will be set within the guideline harvest range for each area based upon the best available information at the start of each season. The harvest range for the directed demersal rockfish fishery in all Southeast Alaska groundfish management areas under the new regulations is 457-630 mt compared to the preliminary harvest limit of 940 mt used as the regional harvest objective during the 1986-87 and 1987-88 seasons. An existing regulation limiting the harvest of all other rockfish species to 880 mt for State-managed waters of S.E. Alaska will remain in effect.

3. Fishing seasons were established based upon a recommendation from the Work Group with the directed fishery for demersal shelf rockfish opening on October 1 each year. No more than 43% of the annual harvest objective for each year can be taken during October and November. An additional 42% may be taken from December 1 through May 15 with the remainder of the harvest (15%) reserved for a summer season beginning on July 1. This regulation was proposed by the working group as a means of spreading out the harvest over a broader portion of the year and it will at least partially satisfy that objective. The May 15 - July 1 closure coincides with a period of "soft" rockfish markets and with the peak parturition period for yelloweye rockfish.

4. Waters of Sitka Sound in the Sitka area and portions of the immediate area around Ketchikan were closed to directed fishing for rockfish. The Sitka area closure was proposed by ADF&G staff. It formalizes an extended Emergency Order closure of the area which had been in effect over the previous two seasons. The Ketchikan area closure was proposed by members of the public and modified by the Board of Fisheries based upon testimony received at the Board of Fisheries meeting. This action was taken in response to information indicating that significant declines in rockfish populations have occurred in both of those areas in recent years. Parallel regulations substantially reducing sport fishing bag limits were also adopted for those areas. The rationale behind this action was that since rockfish are so vulnerable to over-exploitation, stocks in areas where sport, commercial, and personal use fisheries overlap cannot tolerate any directed

fishing pressure. Fishermen wishing to fish in the immediate vicinity of either Sitka or Ketchikan should obtain specific information regarding area closures prior to fishing.

5. When the directed rockfish fishery is closed and in areas with permanent closures to directed rockfish fishing (Sitka and Ketchikan areas) any Commercial Fisheries Entry Commission (CFEC) permit holder may retain rockfish only up to 10% by weight of all species on board. However, rockfish may be retained without restriction while fishing for halibut during a regular commercial halibut opening. These regulations were proposed by ADF&G staff at the request of the industry and Work Group participants. They were adopted to meet the objective of minimizing waste of rockfish in fisheries for other species by allowing full utilization of all rockfish harvested.

6. A Work Group proposal to limit the amount of rockfish landed by any fisherman during a weekly fishing period was adopted. The regulation states that during the directed demersal shelf rockfish fishery no vessel or individual CFEC permit holder may land more than 7,500 pounds (3.4 mt round weight) of demersal shelf rockfish during any five-day period. This action was recommended by the Work Group for two reasons. A weekly trip limit should help to spread out the harvest over a longer time period. It is also designed to maintain the rockfish harvest as a small-vessel fishery and reduce the risk of larger vessels catching the quota in a short time thus precluding the full participation of the existing small-vessel fleet.

7. A regulation requiring all participants in the directed demersal shelf rockfish fishery to maintain logbooks was also adopted. This regulation was requested by the Work Group as a way to provide better information with which to manage this fishery. The language of the regulation is very similar to the logbook requirement currently in effect for the halibut fishery in Alaska.

8. ADF&G staff recommended rescinding the previous regulation requiring annual area registration for the Southeastern and Yakutat areas. This recommendation was adopted based upon testimony that the registration requirement as structured serves no useful purpose in Southeast Alaska groundfish fisheries and thus places an unnecessary burden on the fishermen and the staff.

9. Under new regulations, bait harvest of groundfish for individual use is now included in the commercial regulations. With this provision, the taking of demersal shelf rockfish will be limited to no more than 10% by weight of all fish on board as it is in other non-target fisheries (see no. 5 above). This action was originally recommended by ADF&G's regional staff, but the regulations as passed were recommended by a sub-group appointed by the Board of Fisheries at their annual meeting.

IMPLEMENTATION OF CURRENT REGULATIONS

ADF&G will manage the fishery using the guideline harvest ranges and seasons outlined above through Emergency Order authority. The landings will be monitored closely from fish tickets and projections will be made based on catch rates and effort levels. Where possible, at least three days notice will be given of an impending closure.

An annual harvest objective within the guideline harvest ranges will be determined prior to October 1 of each year for each management area based upon the best available information on rockfish stock conditions in each area. Data used for setting the annual harvest objective will include survey information, catch data, skipper interviews, port sampling data, and logbook data. The annual harvest objectives will be separated into seasonal segments for each management area according to the percentages prescribed in the regulations.

The fishery will be managed such that if a seasonal segment of the annual harvest objective set for an area is not taken during that segment of the season, the amount below the harvest objective for that segment will be carried over and added onto the target harvest for the next season segment. That will occur in all cases unless there is a justification for early closure of an area for conservation of the resource. Conversely, if a harvest greater than the objective set for a given segment is taken from a management area during that season segment, the amount of over harvest will be reduced from the allowed catch in that area during the next segment of the season.

FUTURE ROCKFISH MANAGEMENT

The regulations for demersal shelf rockfish and the other rockfish mentioned above will remain in effect through the 1990-91 season or until changed by subsequent regulatory action. Closures of area fisheries at levels below the established harvest ranges will occur only if a serious conservation concern develops.

At the direction of the Board of Fisheries, the staff will closely monitor the fishery and continue its stock assessment surveys to attempt to determine if the harvest limits currently in place are sustainable. ADF&G has been instructed to report to the Board during the 1990/91 winter meetings concerning the feasibility of maintaining a directed demersal shelf rockfish fishery in the future.

In addition to the more conventional management procedures adopted by the Board of Fisheries, the Work Group recommended that limited access be investigated as an option for the Southeast Alaska rockfish fishery. Because of the large number of past participants in the rockfish fishery, the Work Group members were particularly interested in exploring some form of individual fishing quota (IFQ) program. Additional funding has been requested through the Interjurisdictional Fisheries Fund to examine that option over the next year.

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Table 1. Demersal shelf rockfish harvest ranges in metric tons by Southeast Alaska rockfish management area and season segment for the 1989-90 fishing season.[1]

Management Area	October 1- November 30	December 1- May 15	July 1- September 30	Total
CSEO	64.5 - 86	63 - 84	22.5 - 30	150 - 200
NSEI	19.5 - 26	19 - 25	7 - 9	45 - 60
NSEO	16 - 21.5	15.5 - 21	5.5 - 7.5	37 - 50
SSEI	43 - 64.5	42 - 63	15 - 22.5	100 - 150
SSEO	54 - 73	52.5 - 71.5	19 - 25.5	125 - 170
TOTAL	197 - 271	192 - 264.5	69 - 94.5	457 - 630

[1] Target harvest levels for the 1989-90 season are presented in underlined type.

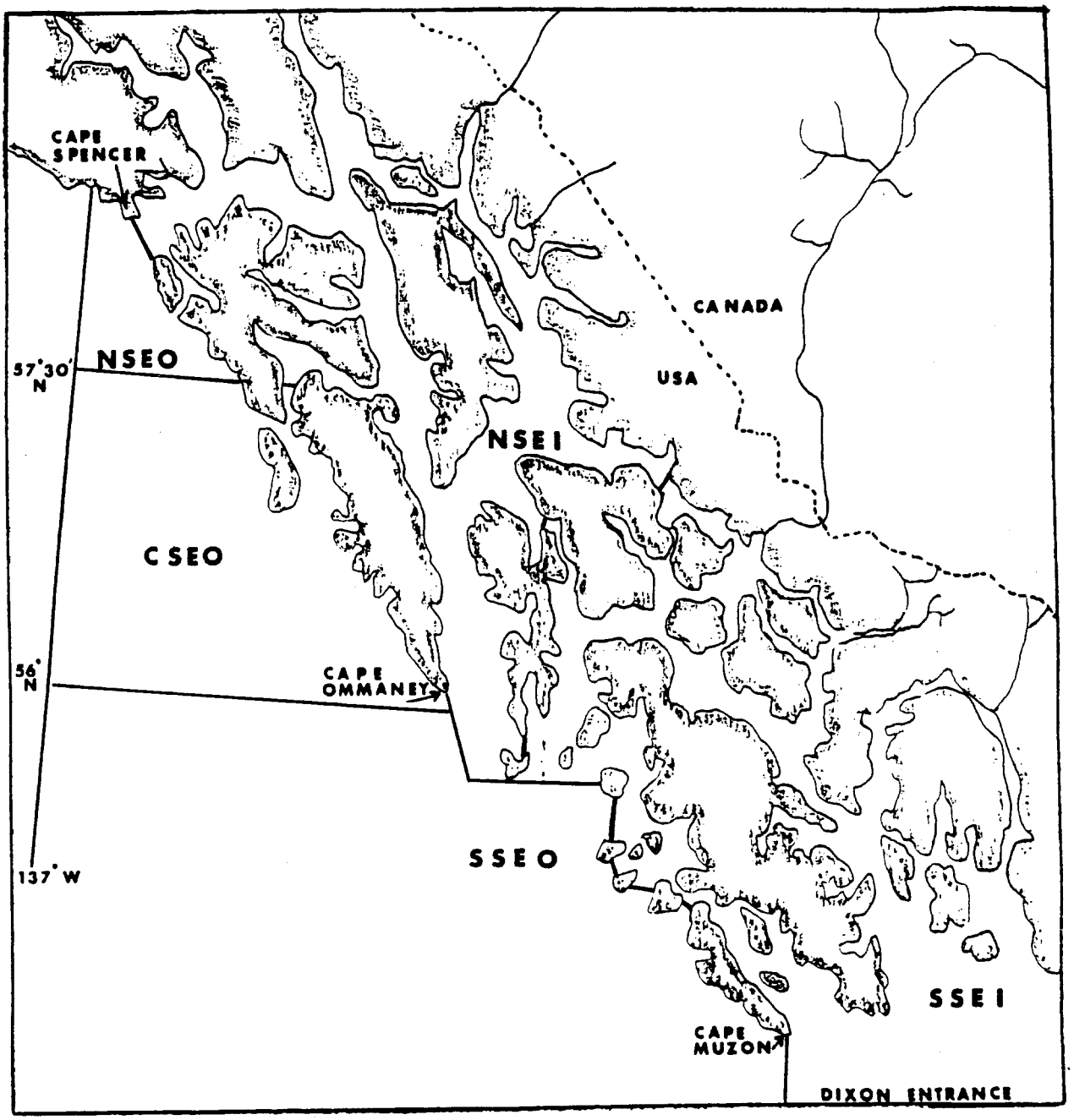

Figure 1. Alaska Department of Fish and Game groundfish management areas in Southeast Alaska.